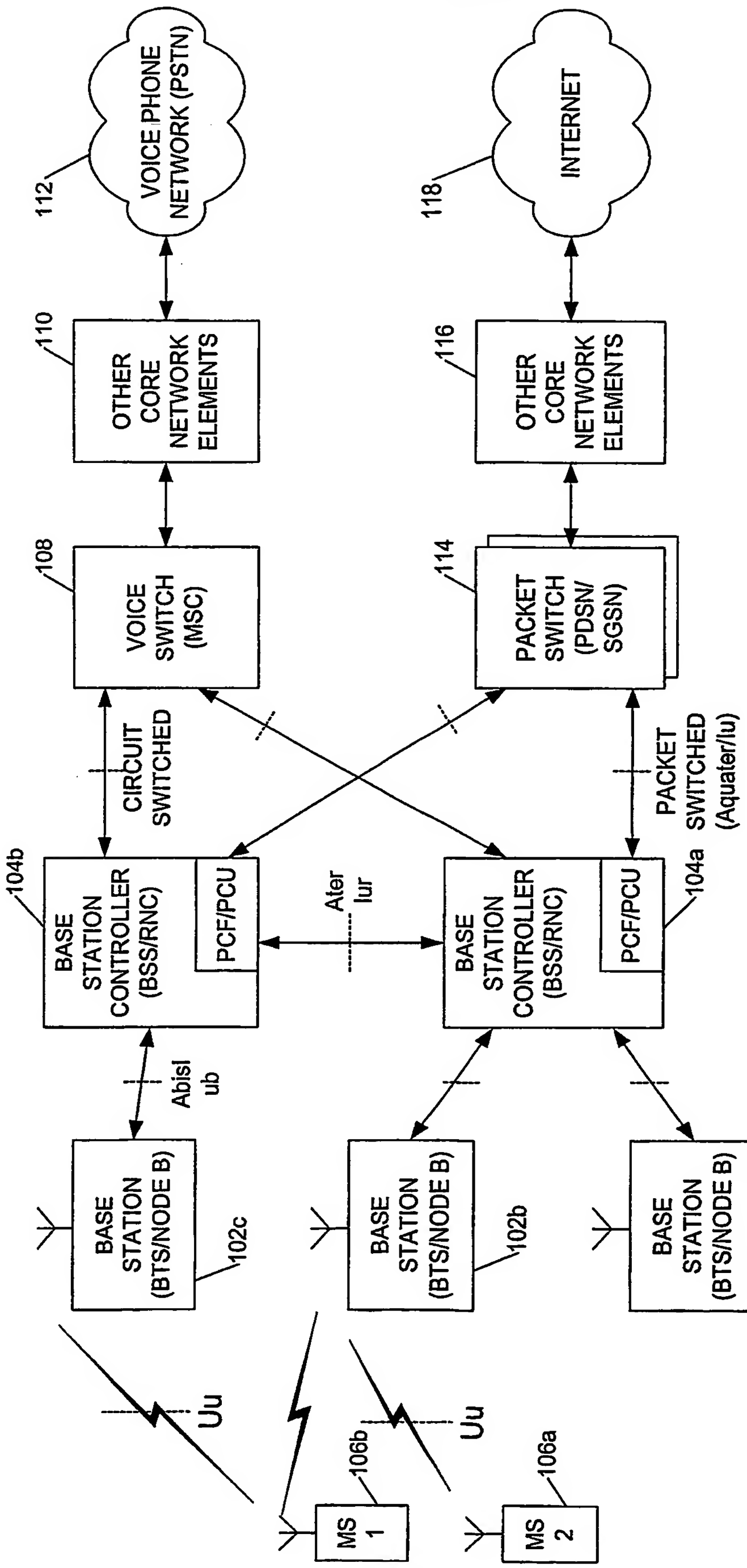

VOICE PHONE NETWORK (PSTN)
112
INTERNET
118
OTHER CORE NETWORK ELEMENTS
110
OTHER CORE NETWORK ELEMENTS
116
VOICE SWITCH (MSC)
108
PACKET SWITCH (PDSN/ SGSN)
114
CIRCUIT SWITCHED
PACKET SWITCHED (Aquater/Iu)
BASE STATION CONTROLLER (BSS/RNC)
104b
PCF/PCU
Ater
Iur
BASE STATION CONTROLLER (BSS/RNC)
PCF/PCU
104a
Abisl ub
BASE STATION (BTS/NODE B)
102c
BASE STATION (BTS/NODE B)
102b
BASE STATION (BTS/NODE B)
102a
Uu
Uu
106b
106a
MS 1
MS 2
100

Figure 1

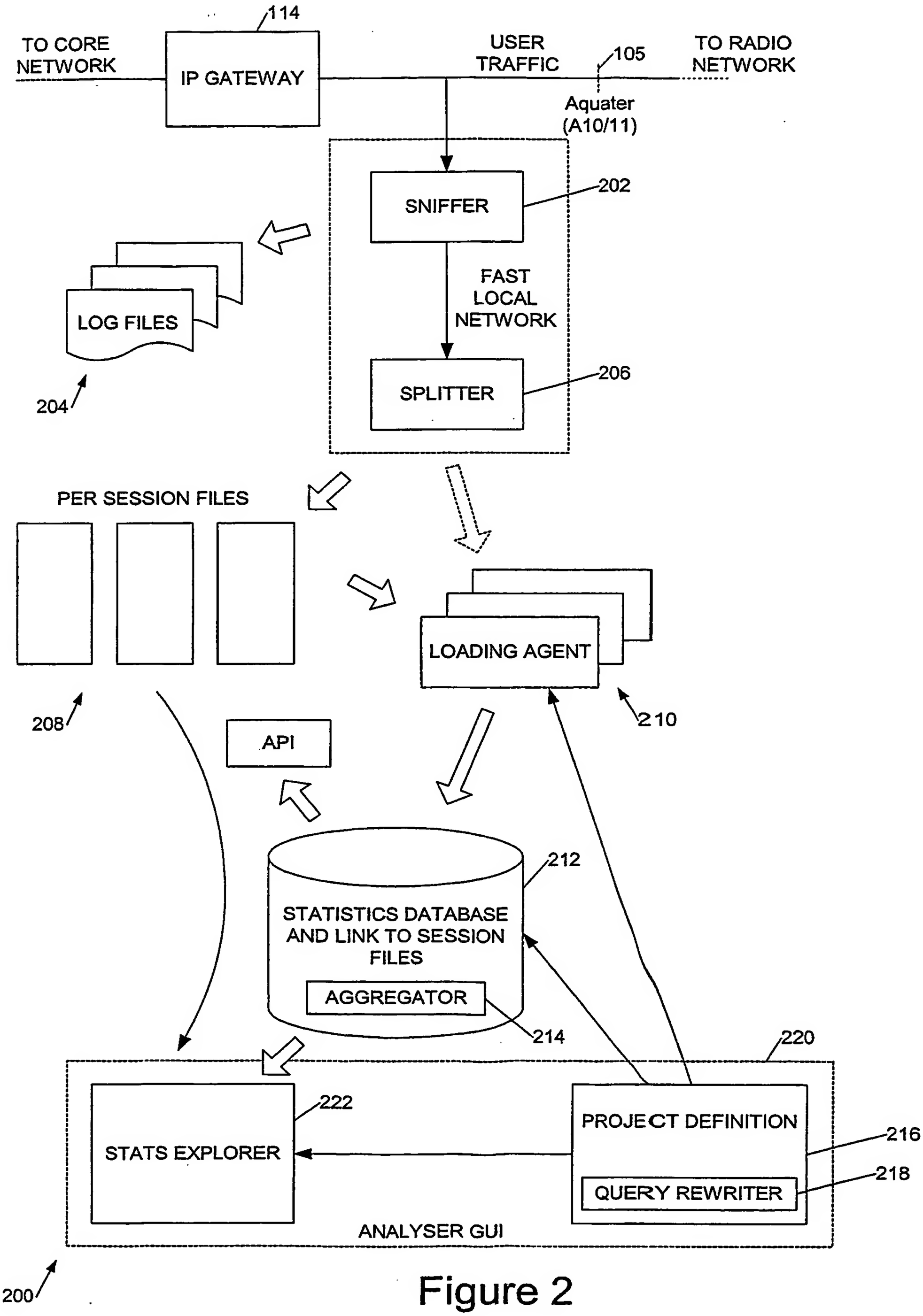

114
TO CORE NETWORK
IP GATEWAY
USER TRAFFIC
105
TO RADIO NETWORK
Aquater (A10/11)
SNIFFER
202
FAST LOCAL NETWORK
SPLITTER
206
LOG FILES
204
PER SESSION FILES
208
LOADING AGENT
210
API
STATISTICS DATABASE AND LINK TO SESSION FILES
212
AGGREGATOR
214
220
STATS EXPLORER
222
PROJECT DEFINITION
216
QUERY REWRITER
218
ANALYSER GUI
200

Figure 2

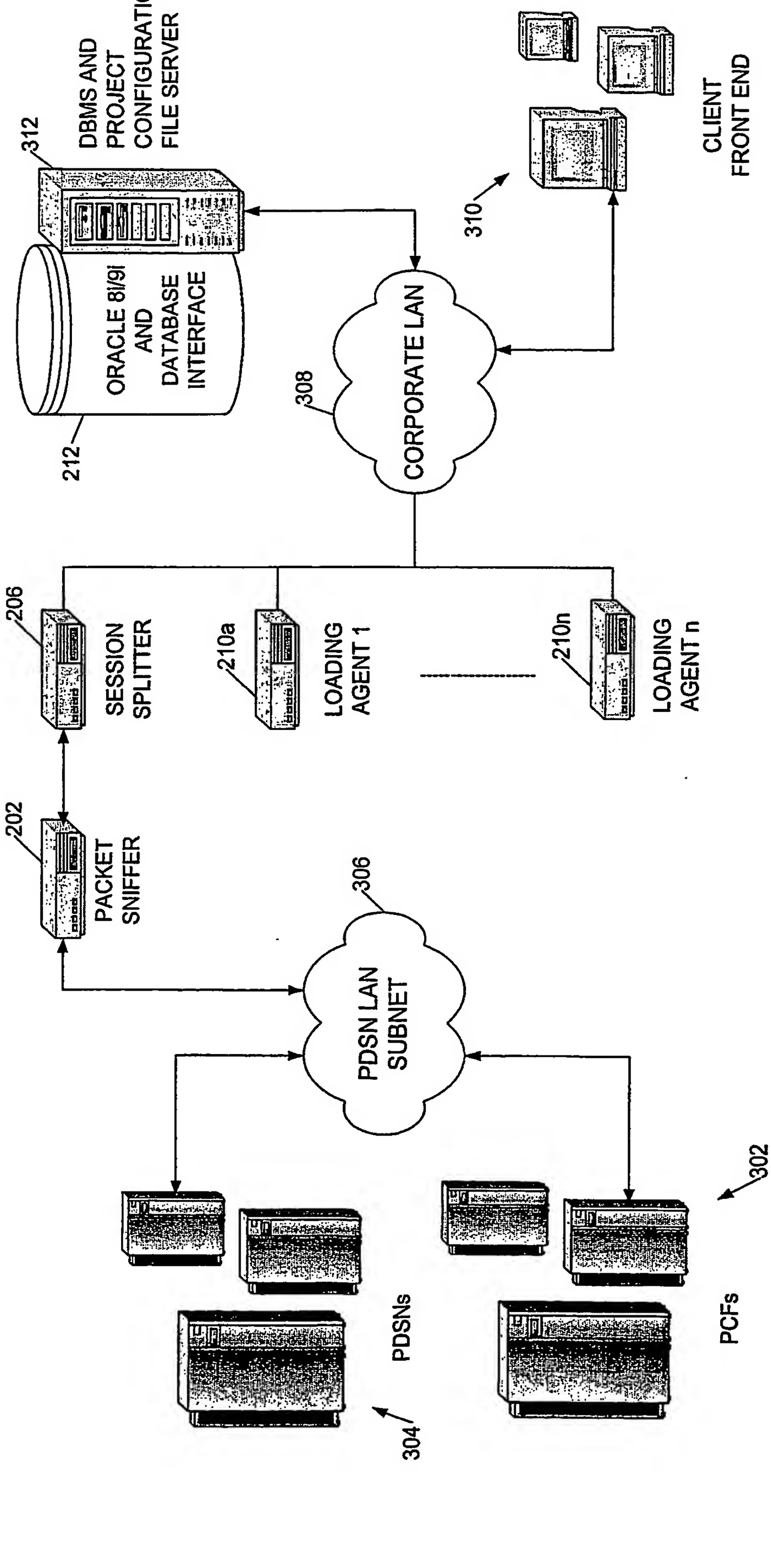

DBMS AND
PROJECT
CONFIGURATION
FILE SERVER
312
ORACLE 8I/9I
AND
DATABASE
INTERFACE
212
CLIENT
FRONT END
310
308
CORPORATE LAN
206
SESSION
SPLITTER
210a
LOADING
AGENT 1
210n
LOADING
AGENT n
202
PACKET
SNIFFER
306
PDSN LAN
SUBNET
302
PCFs
304
PDSNs
300

Figure 3

S400
READ LOG FILE DATA
S402
FOR EACH MESSAGE IN TURN DECODE PROTOCOL STACK AND WRITE TO DATA PIPE
MESSAGES
PARAMS
DATA PIPE
404
SESSION TRACK
SESSION EXPORT
S410
READ MESSAGE AND IF THREAD IDENTIFIABLE WRITE SESSION ID
S412
MESSAGE INCLUDES INFORMATION USABLE TO RESOLVE A MESSAGE THREAD?
N
STOP
Y
S414
RESOLVE UNCERTAINTITIES: WRITE SESSION ID FOR ALL PAST MESSAGES INTO DATA PIPE
408
S416
READ MESSAGE AND SESSION ID
S418
CREATE SESSION DATA FILE, APPEND MESSAGE TO SESSION DATA FILE, OR DISCARD
406
206

Figure 4

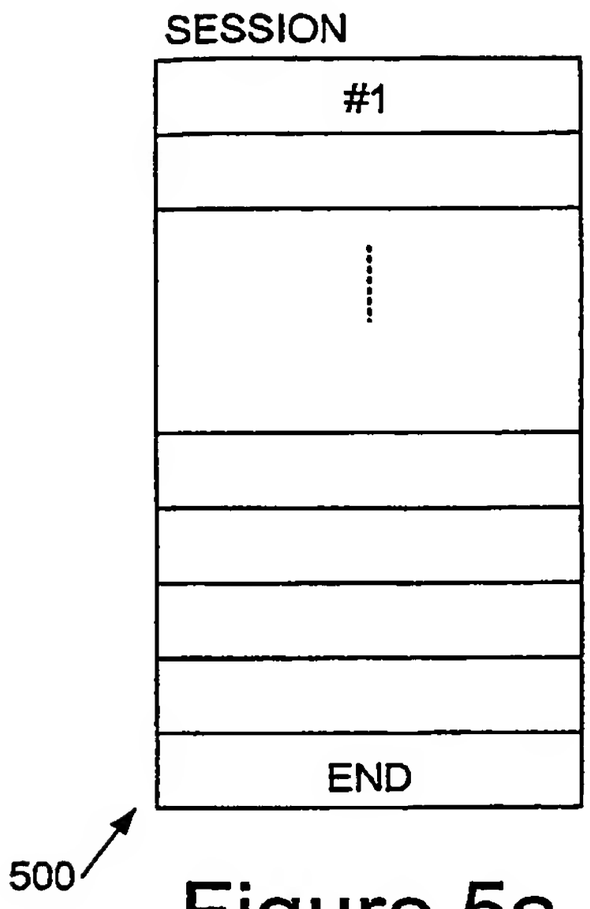


Figure 5a

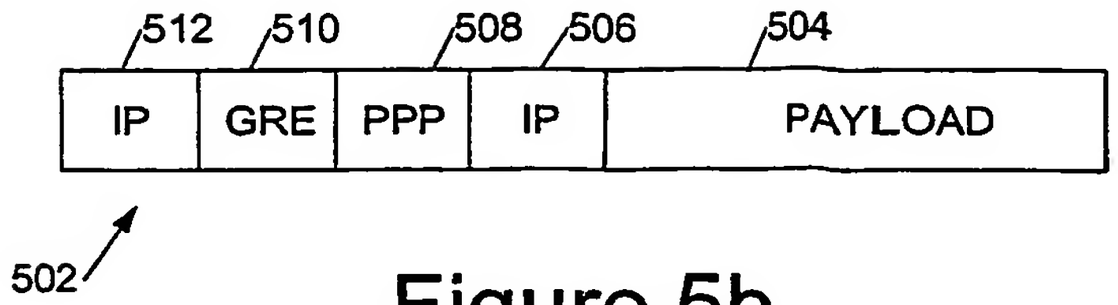


Figure 5b

DIM 1	DIM 2	STAT 1	STAT 2	STAT N
1	1			
1	2			
1	3			
2	1			
2	2			
2	3			

Figure 5e

Figure 5c

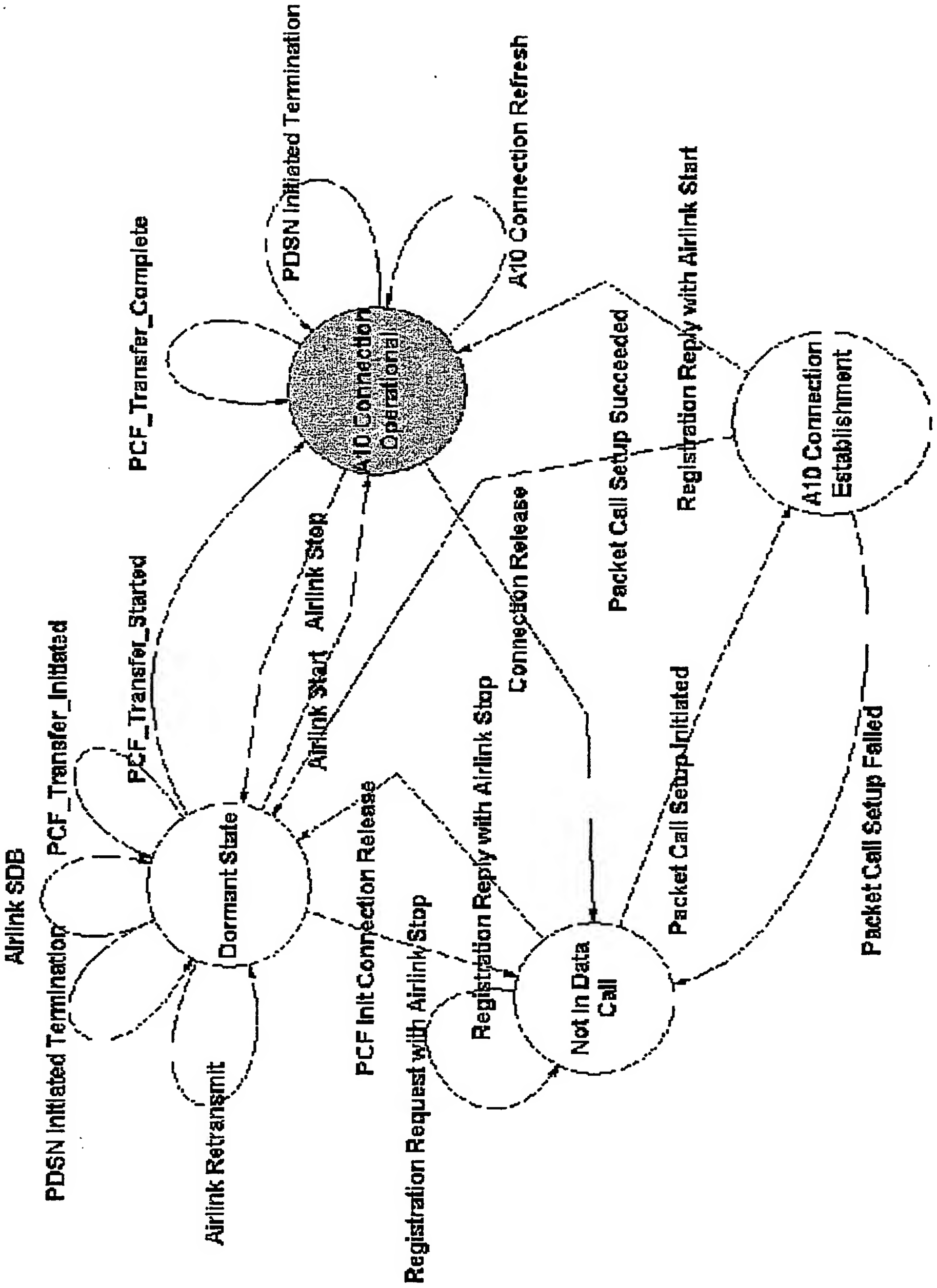

Airlink SDB
PCF_Transfer_Initiated
PDSN Initiated Termination
PCF_Transfer_Started
PCF_Transfer_Complete
PDSN Initiated Termination
Dormant State
Airlink Start
Airlink Stop
A10 Connection Operational
A10 Connection Refresh
Connection Release
Packet Call Setup Succeeded
Registration Reply with Airlink Start
Connection Release
Airlink Stop
Registration Reply with Airlink Stop
Packet Call Setup Initiated
A10 Connection Establishment
Packet Call Setup Failed
Airlink Retransmit
PCF Init Connection Release
Registration Request with Airlink Stop
Registration Request
Not In Data Call

Figure 5d

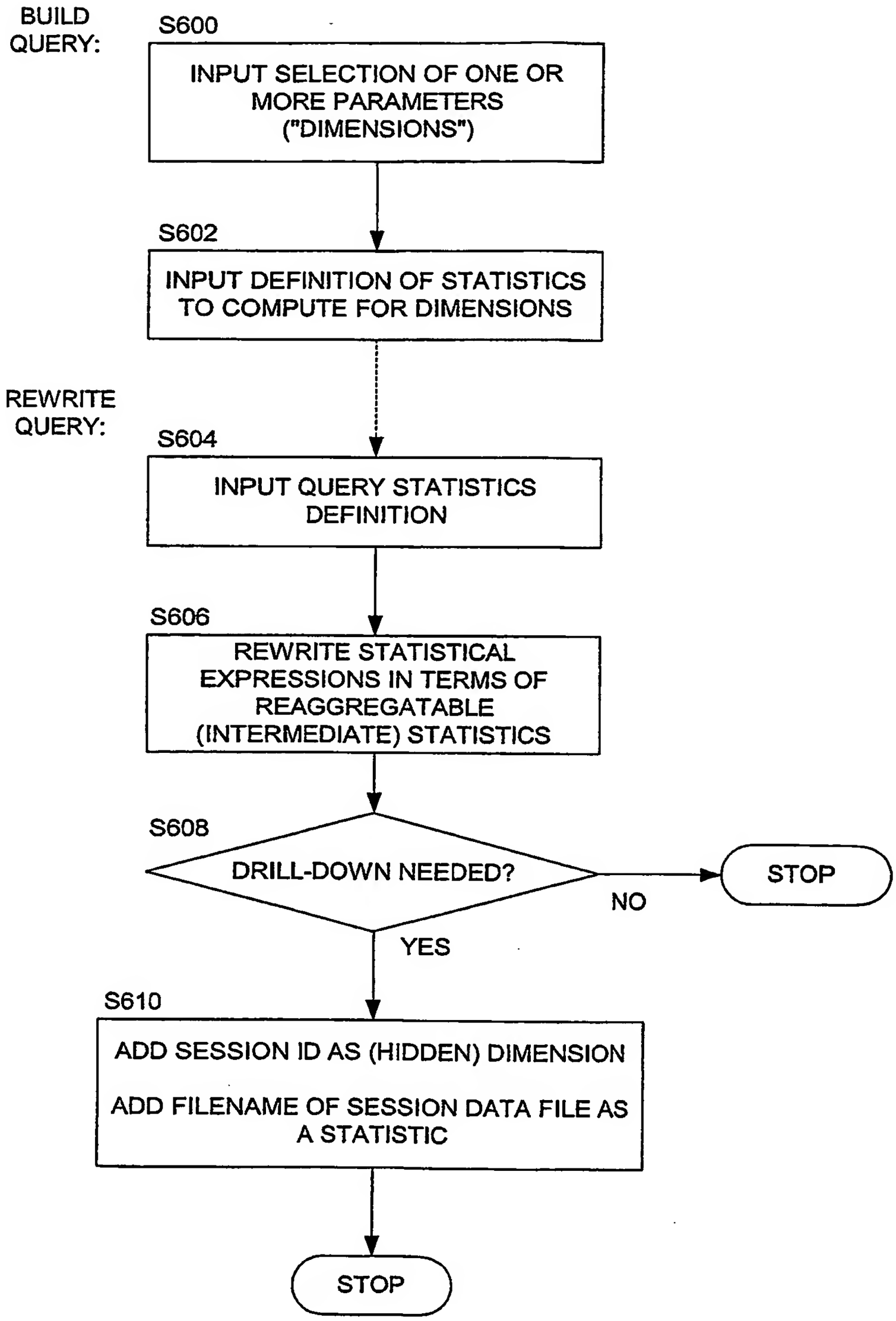

BUILD QUERY:
S600
INPUT SELECTION OF ONE OR MORE PARAMETERS ("DIMENSIONS")
S602
INPUT DEFINITION OF STATISTICS TO COMPUTE FOR DIMENSIONS
REWRITE QUERY:
S604
INPUT QUERY STATISTICS DEFINITION
S606
REWRITE STATISTICAL EXPRESSIONS IN TERMS OF REAGGREGATABLE (INTERMEDIATE) STATISTICS
S608
DRILL-DOWN NEEDED?
NO
STOP
YES
S610
ADD SESSION ID AS (HIDDEN) DIMENSION
ADD FILENAME OF SESSION DATA FILE AS A STATISTIC
STOP

Figure 6

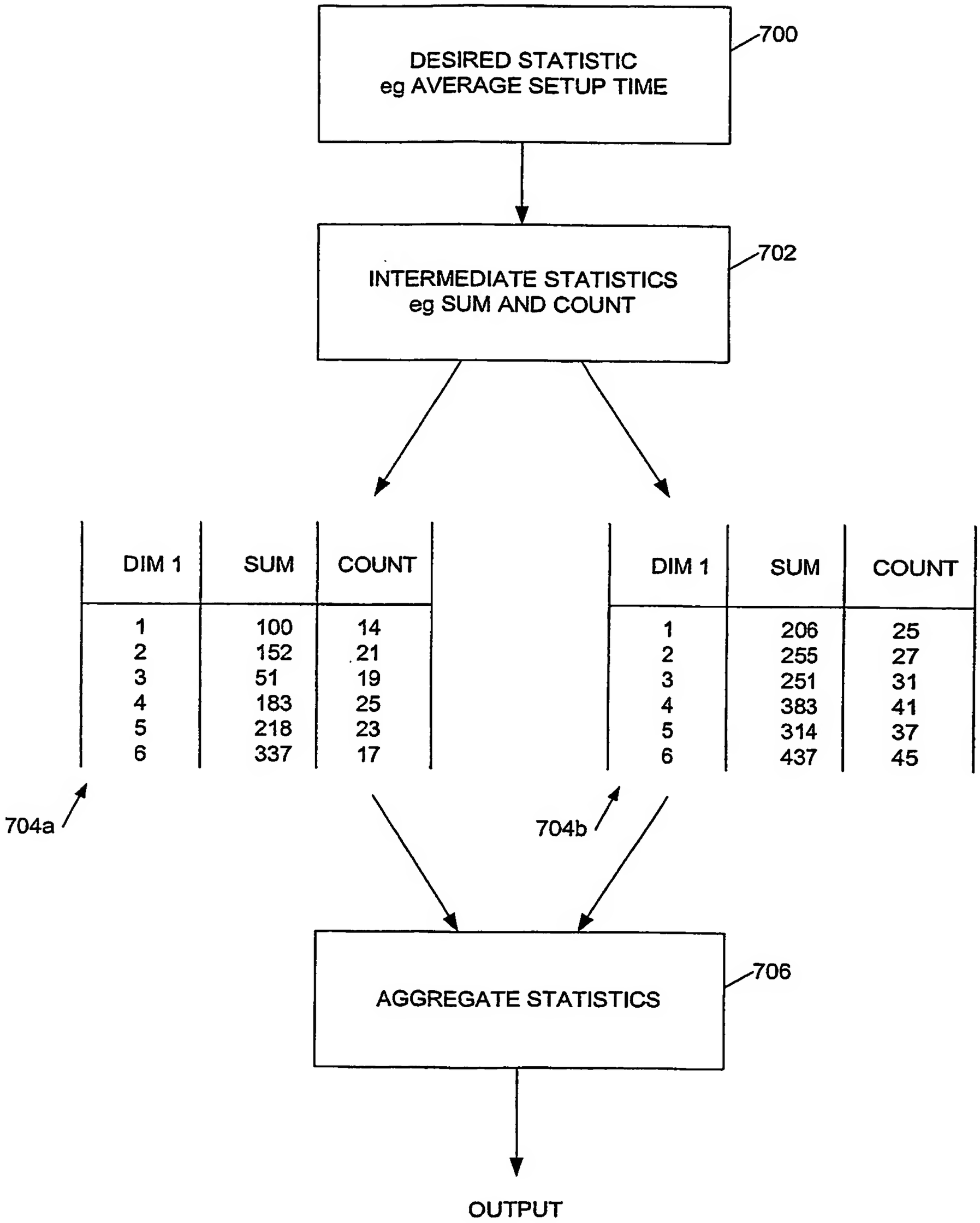

DESIRED STATISTIC
eg AVERAGE SETUP TIME
700
INTERMEDIATE STATISTICS
eg SUM AND COUNT
702
DIM 1 SUM COUNT
1 100 14
2 152 21
3 51 19
4 183 25
5 218 23
6 337 17
704a
DIM 1 SUM COUNT
1 206 25
2 255 27
3 251 31
4 383 41
5 314 37
6 437 45
704b
AGGREGATE STATISTICS
706
OUTPUT

Figure 7

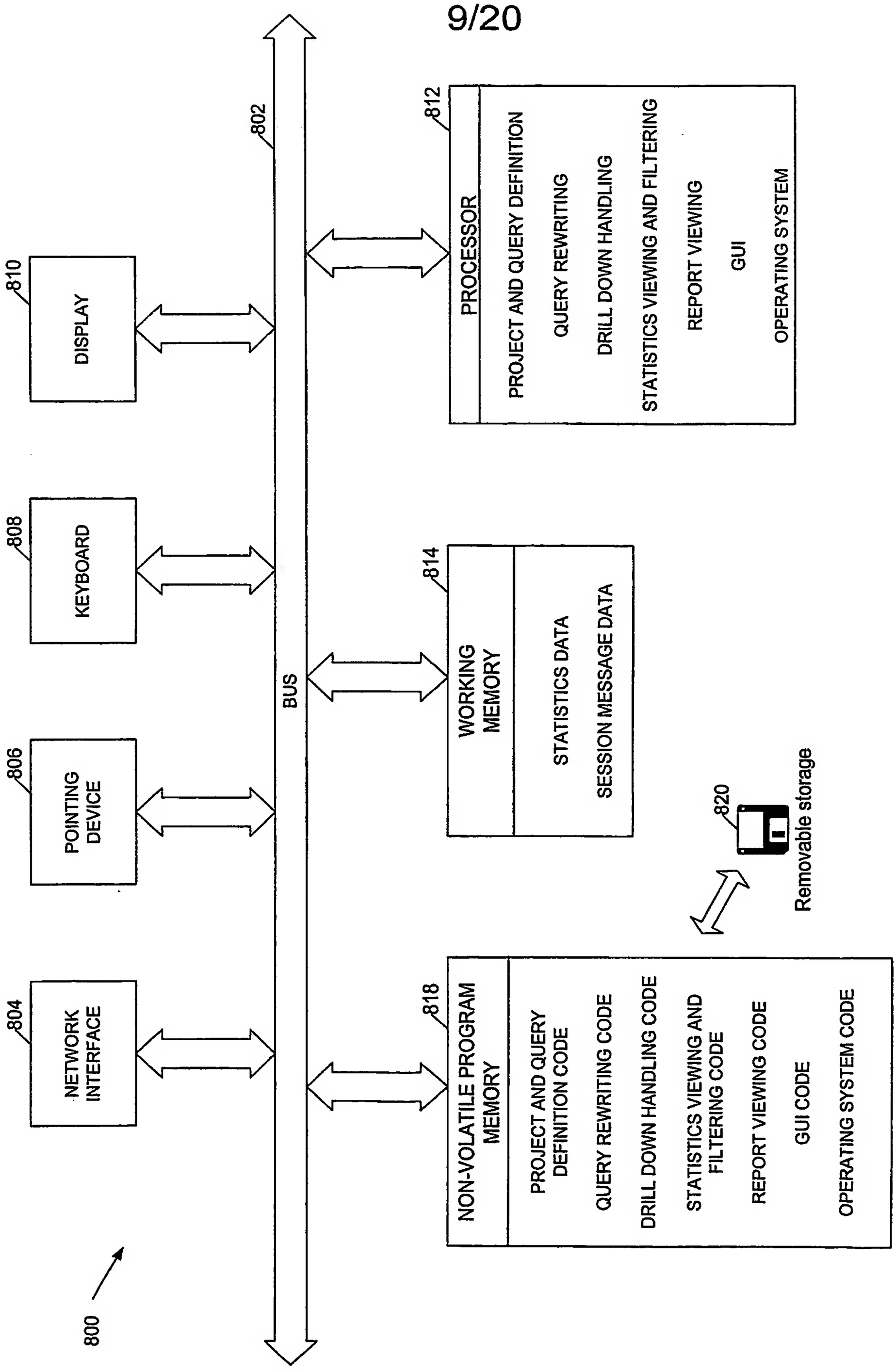
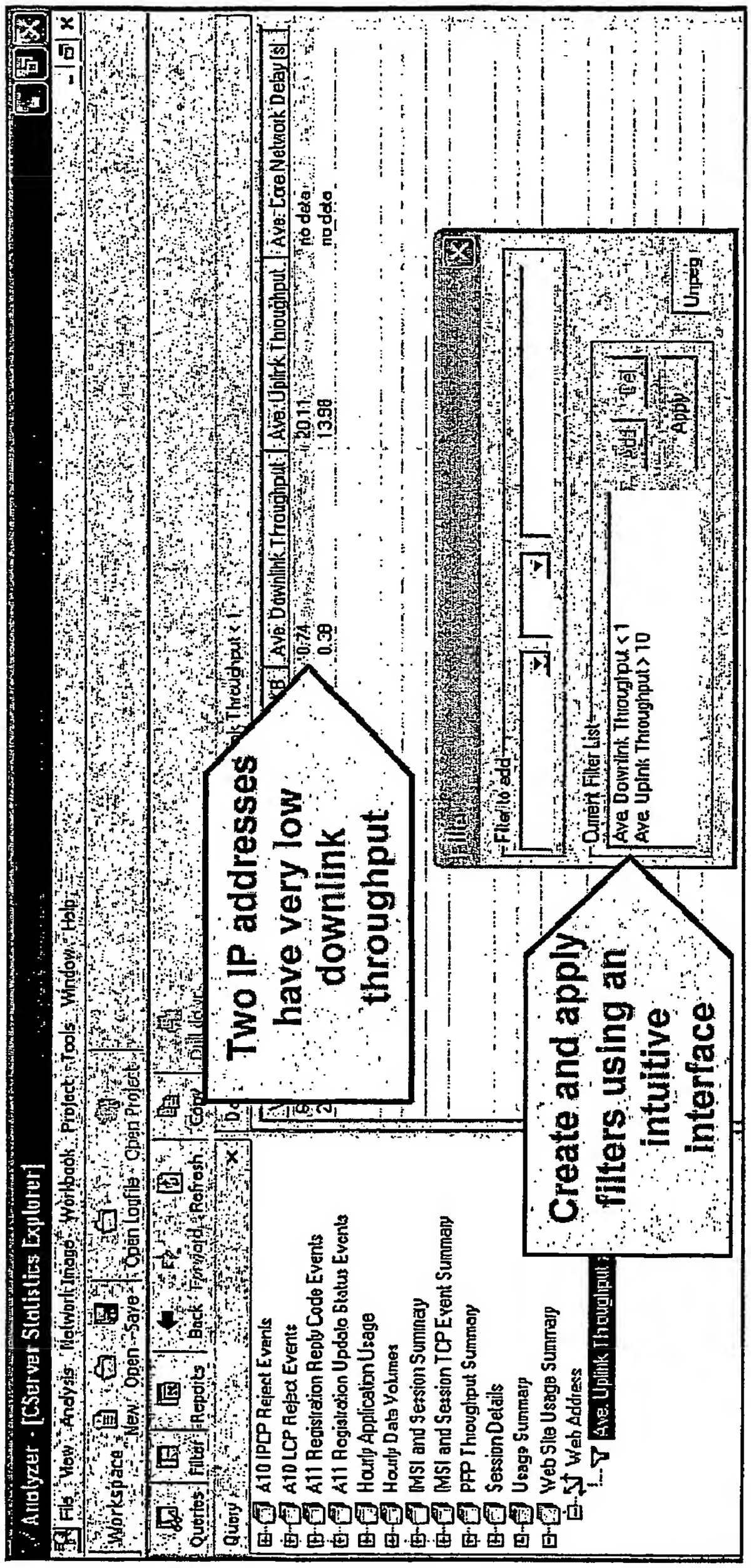

800
BUS
802
804
NETWORK INTERFACE
806
POINTING DEVICE
808
KEYBOARD
810
DISPLAY
812
PROCESSOR
PROJECT AND QUERY DEFINITION
QUERY REWRITING
DRILL DOWN HANDLING
STATISTICS VIEWING AND FILTERING
REPORT VIEWING
GUI
OPERATING SYSTEM
814
WORKING MEMORY
STATISTICS DATA
SESSION MESSAGE DATA
818
NON-VOLATILE PROGRAM MEMORY
PROJECT AND QUERY DEFINITION CODE
QUERY REWRITING CODE
DRILL DOWN HANDLING CODE
STATISTICS VIEWING AND FILTERING CODE
REPORT VIEWING CODE
GUI CODE
OPERATING SYSTEM CODE
820
Removable storage

Figure 8


Analyzer - [Server Statistics Explorer]
File View Analysis Network Image Workbook Project Tools Window Help
Workspace New Open Save Open Logfile
Queries Filter Reports Back Forward Refresh
Query
A10 IPCP Reject Events
A10 LCP Reject Events
A11 Registration Reply Code Events
A11 Registration Update Status Events
Hourly Application Usage
Hourly Data Volumes
IMSI and Session Summary
IMSI and Session TCP Event Summary
PPP Throughput Summary
Session Details
Usage Summary
Web Site Usage Summary
Web Address
Ave. Uplink Throughput
Ave. Downlink Throughput
Ave. Uplink Throughput
Ave. Downlink Throughput
Ave. Uplink Throughput
Ave. Downlink Throughput

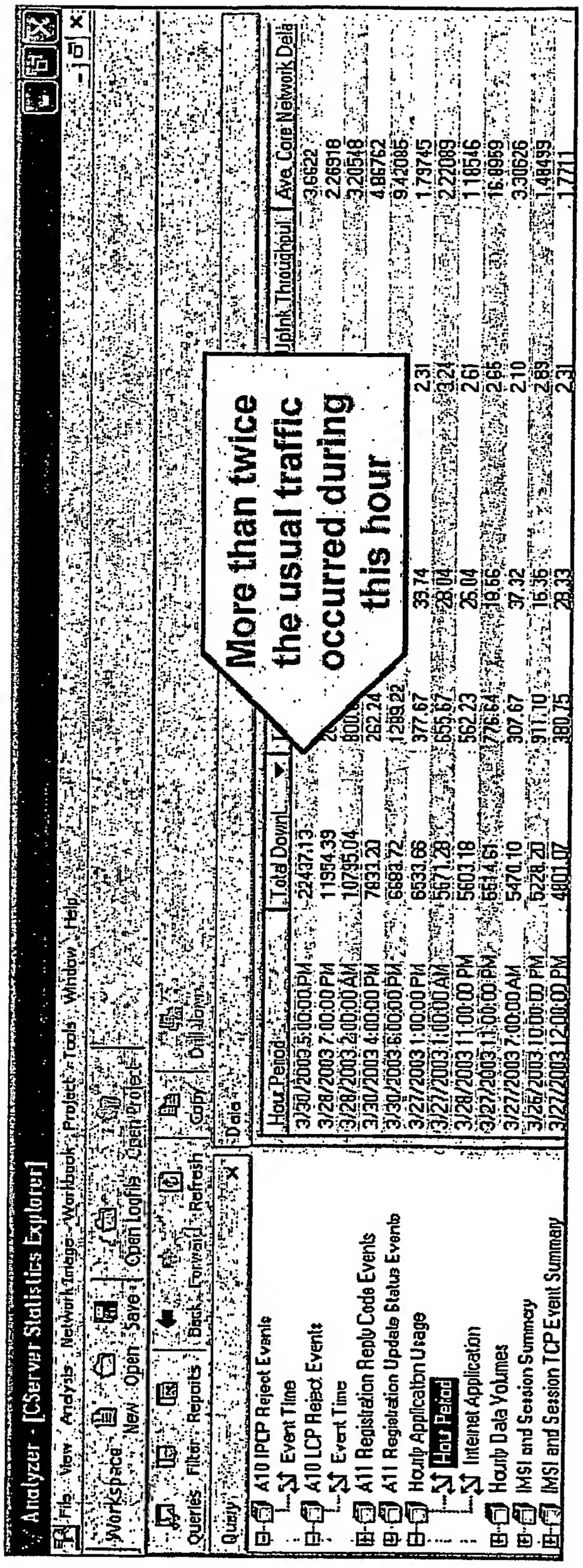

Analyzer - [Server Statistics Explorer]
File View Analysis Network Image Workbook Project Tools Window Help
Workspace New Open Save Open Logfile
Queries Filter Reports Back Forward Refresh
Query
A10 IPCP Reject Events
Event Time
A10 LCP Reject Events
Event Time
A11 Registration Reply Code Events
A11 Registration Update Status Events
Hourly Application Usage
Hour Period
Internet Application
Hourly Data Volumes
IMSI and Session Summary
IMSI and Session TCP Event Summary
Hour_Period
Total Down
Uplink Throughput
Ave. Core Network Dela
3/30/2003 5:00:00 PM 22437.13 3.6622
3/28/2003 7:00:00 PM 1154.39 2.26918
3/28/2003 2:00:00 AM 1079.04 3.20548
3/30/2003 4:00:00 PM 7831.20 4.86762
3/30/2003 6:00:00 PM 6683.72 9.42085
3/27/2003 1:00:00 PM 6533.66 1.79745
3/27/2003 1:00:00 AM 5671.28 2.22089
3/28/2003 11:00:00 PM 5603.18 1.18516
3/27/2003 11:00:00 PM 5514.67 16.8959
3/27/2003 7:00:00 AM 5470.10 3.30626
3/26/2003 10:00:00 PM 5228.20 1.48499
3/27/2003 12:00:00 PM 4801.07 1.7711
More than twice the usual traffic occurred during this hour

Figure 10

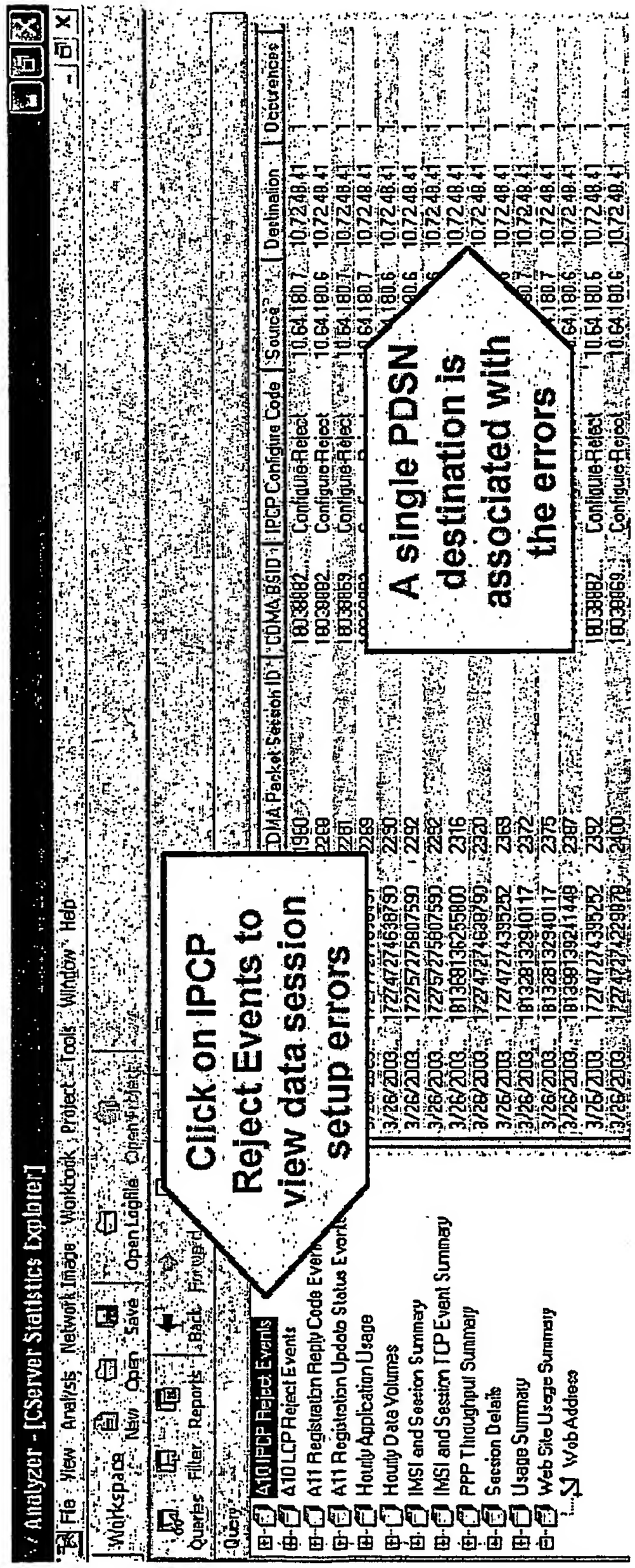

Analyzer - [CServer Statistics Explorer]
File View Analysis Network Image WorkBook Project Tools Window Help
Workspace New Open Save Open Logfile
Queries Filter Reports Back Forward
Query
A10/IPCP Reject Events
A10 LCP Reject Events
A11 Registration Reply Code Events
A11 Registration Update Status Events
Hourly Application Usage
Hourly Data Volumes
IMSI and Session Summary
IMSI and Session TCP Event Summary
PPP Throughput Summary
Session Details
Usage Summary
Web Site Usage Summary
Web Address
Click on IPCP Reject Events to view data session setup errors
A single PDSN destination is associated with the errors
Source IP Destination Occurences
DMA Packet Session ID CDMA BSID IPCP Configure Code Source
1960 180388B2... Configure Reject 10.64.180.7 10.72.48.41 1
2269 180388B2... Configure Reject 10.64.180.6 10.72.48.41 1
2281 180388B9... Configure Reject 10.64.180.7 10.72.48.41 1
2269 10.64.180.6 10.72.48.41 1
3/26/2003 172747274638790 2290 10.64.180.7 10.72.48.41 1
3/26/2003 172757275807590 2292 10.64.180.6 10.72.48.41 1
3/26/2003 172757275807590 2292 10.64.180.7 10.72.48.41 1
3/26/2003 181368136255800 2316 10.64.180.6 10.72.48.41 1
3/26/2003 172747274638790 2320 10.64.180.7 10.72.48.41 1
3/26/2003 172747274395252 2369 10.64.180.6 10.72.48.41 1
3/26/2003 181328132940117 2372 10.64.180.7 10.72.48.41 1
3/26/2003 181328132940117 2375 10.64.180.6 10.72.48.41 1
3/26/2003 181399139211448 2387 10.64.180.7 10.72.48.41 1
3/26/2003 172747274395252 2392 180388B2... Configure Reject 10.64.180.6 10.72.48.41 1
3/26/2003 172747274229878 2400 180388B9... Configure Reject 10.64.180.6 10.72.48.41 1

Figure 11

Time	Origination Time	Packet Data Setup Time	PPP Setup Time	SCH Assignment Time	Total Setup Time
1:31:02 PM	1101	127	1097	4001	10179
1:35:23 PM	2102	141	1213	398	6359
2:02:52 PM	292	112	980	1121	10718
3:13:11 PM	5102	202	2003	906	8213

Figure 12

Metric	Goal	Actual
Average Ec/Io	-14db or better	-7.21
Average Forward FER	2% or less	1.49
Average Reverse FER	2% or less	2.10
% Access Failure	0%	10.71%
% Successful Call Origination	>=90% for Mobile Originating or Mobile Terminating Calls	82.14%
% Dropped Calls (of calls that originated successfully)	2% or less	7.14%

Figure 13

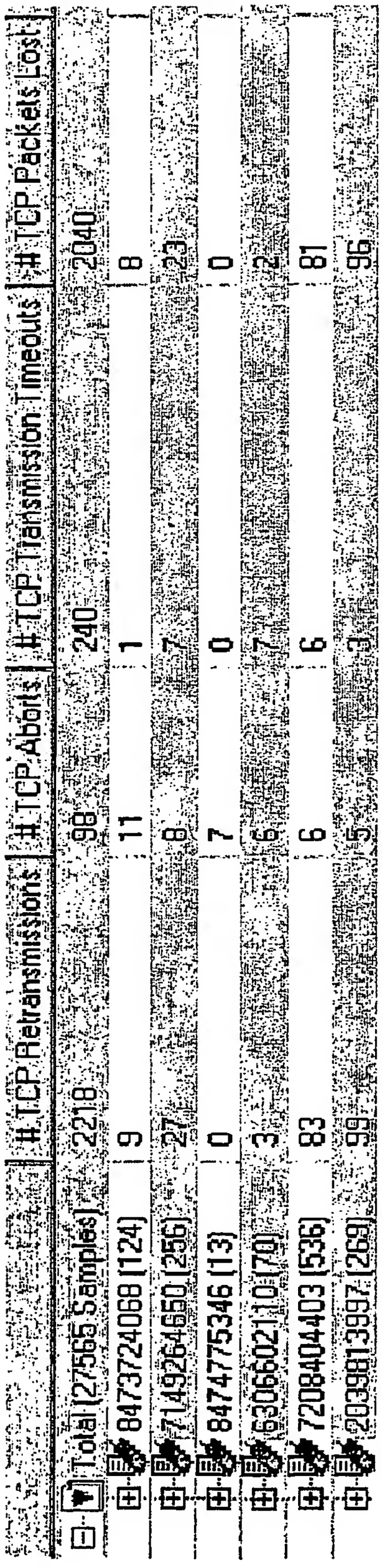

Timeouts | # TCP Packets Lost
2040 8
23 0
2 81
96
TCP Retransmissions | # TCP Aborts | # TCP Transmission Ti
2218 98 240
9 11 1
27 8 7
0 7 0
3 6 7
83 6 6
99 5 3
Total (27565 Samples)
8473724068 (124)
7149264650 (256)
8474775346 (13)
6306602110 (70)
7208404403 (536)
2039813997 (269)

Figure 14

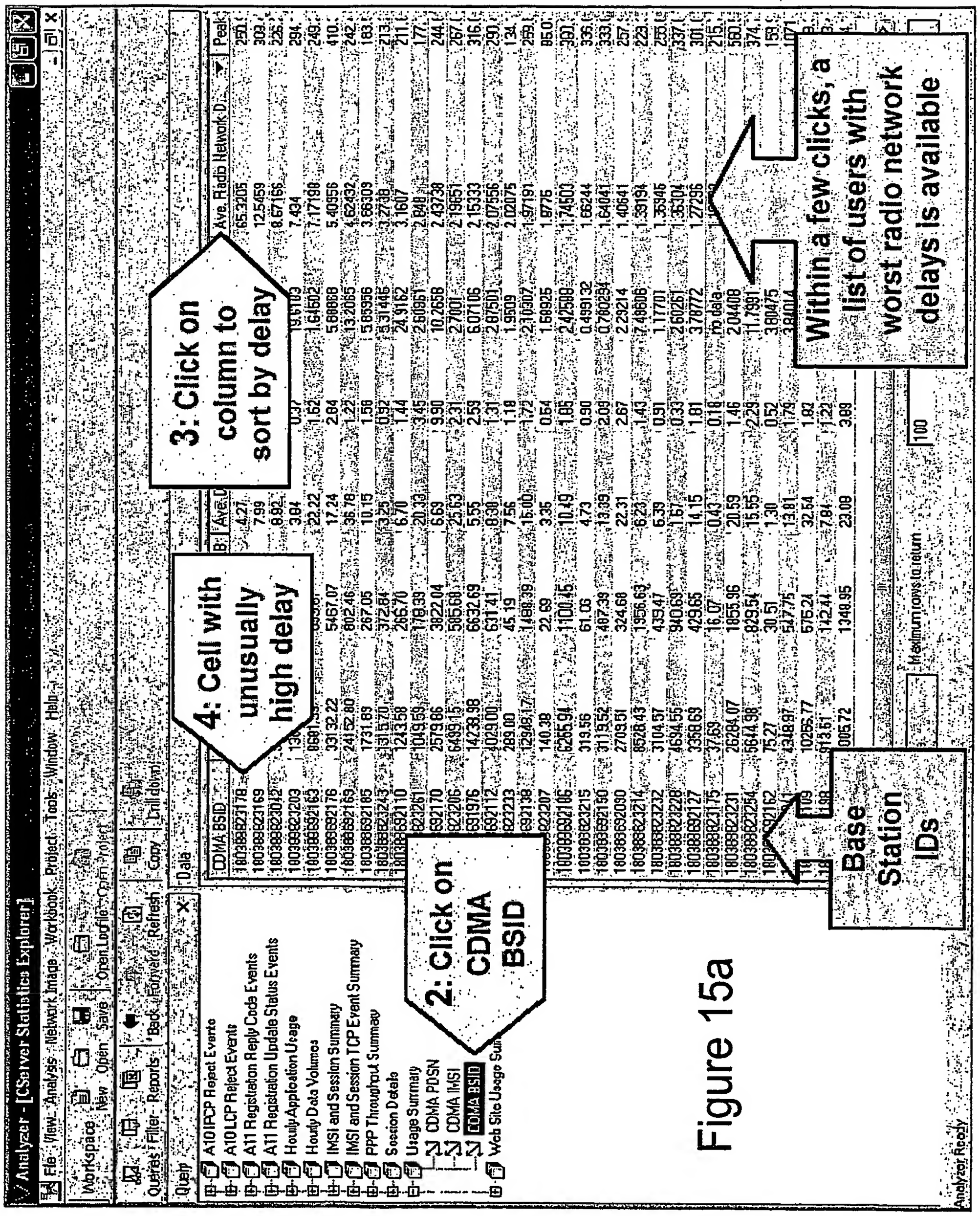

Analyzer - [CServer Statistics Explorer]
File View Analysis Network Image Workbook
Workspace New Open Save Open Logfile
Queries Filter Reports Back Forward Refresh
Query
A10 IPCP Reject Events
A10 LCP Reject Events
A11 Registration Reply Code Events
A11 Registration Update Status Events
Hourly Application Usage
Hourly Data Volumes
IMSI and Session Summary
IMSI and Session TCP Event Summary
PPP Throughput Summary
Session Details
Usage Summary
CDMA PDSN
CDMA IMSI
CDMA BSID
Web Site Usage Sum
Data
CDMA BSID
Ave. Radio Network D...
Peak
Copy
Drill down
Maximum rows to return
100
Base Station IDs
2: Click on CDMA BSID
3: Click on column to sort by delay
4: Cell with unusually high delay
Within a few clicks, a list of users with worst radio network delays is available
Analyzer Ready

Figure 15a

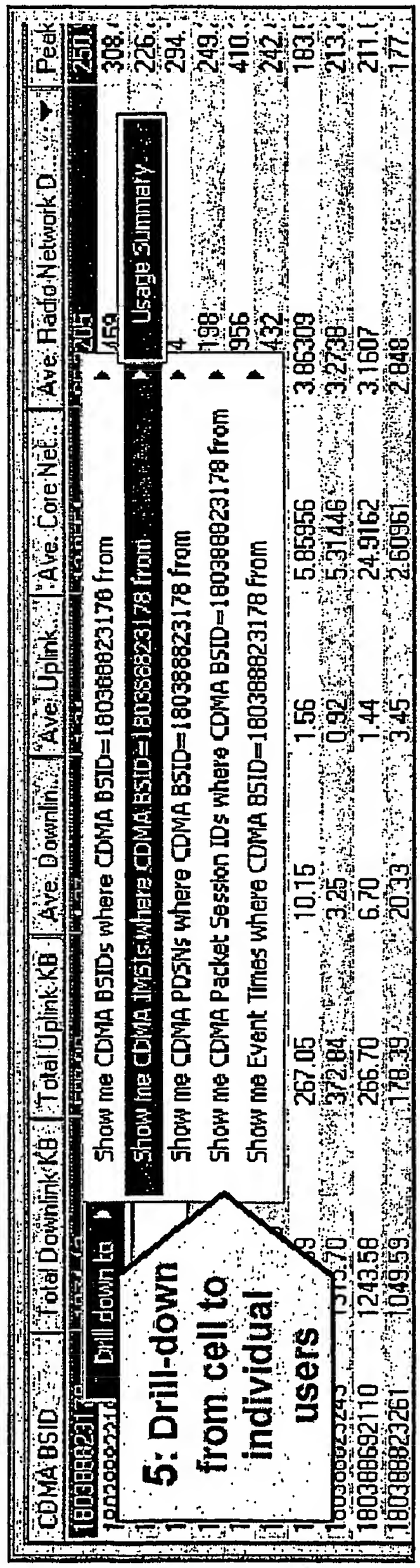


Figure 15b

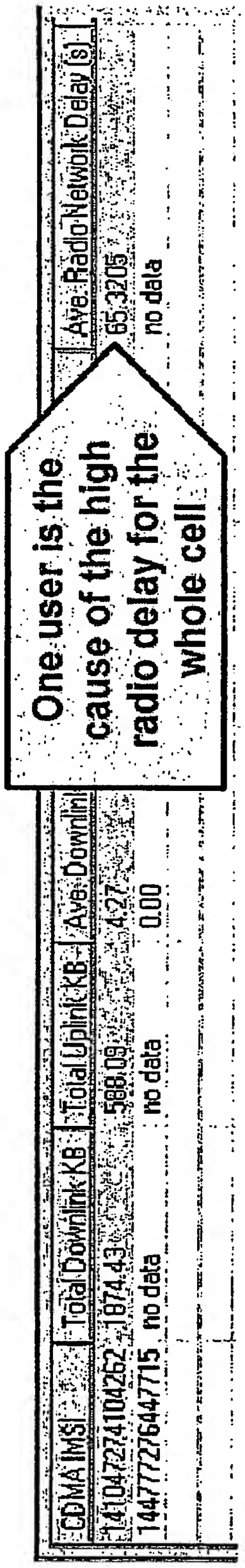


Figure 15c

CDM...	CDMA IMSI	CDMA BSID	Application	Ave. Core Network Delay (s)	Ave. Radio Network D...	Occurene
3192	172747274104262	180388823178	www-http	44.2309	138.074	2665
3889	172747274104262	180388823178	www-http	1.84581	36.431	4711
2266	172747274104262	180388823178	www-http	0.042	31.4985	2044
2526	172747274104262	180388823206	www-http	1.81822	2.61666	4669
2296	172747274104262	180388823178	www-http	1.36825	2.30018	3945
2760	172747274104262	180388823206	www-http	2.17648	1.86458	3224
2291	172747274104262	180388823178	pop3	no data	no data	119

Figure 15d

MIP Registration Reply Code	IMSI	User ID
Total (42 Samples)	Error code from the Foreign Agent - unknown challenge	5902093549	sbostain01@sp
9/11/2002 3:01:17 PM (2)	Error code from the Foreign Agent - home agent port unreachable (ICMP error received)	8474452581	snelson88@spr
9/11/2002 2:58:55 PM (2)	Error code from the Foreign Agent - mobile node failed authentication	8474521587	mark2cool@spr
9/11/2002 2:59:38 PM (4)	Error code from the Foreign Agent - unknown challenge	8475309339	rjacobs66@spri
9/11/2002 3:00:43 PM (2)	Error code from the Foreign Agent - mobile node failed authentication	3123990163	5D42889D@hc
9/11/2002 3:00:42 PM (2)	Error code from the Foreign Agent - unknown challenge	3123990163	5D42889D@hc
9/11/2002 2:59:59 PM (2)	Error code from the Foreign Agent - stale challenge	3123993627	rdekker01@spr

Figure 16

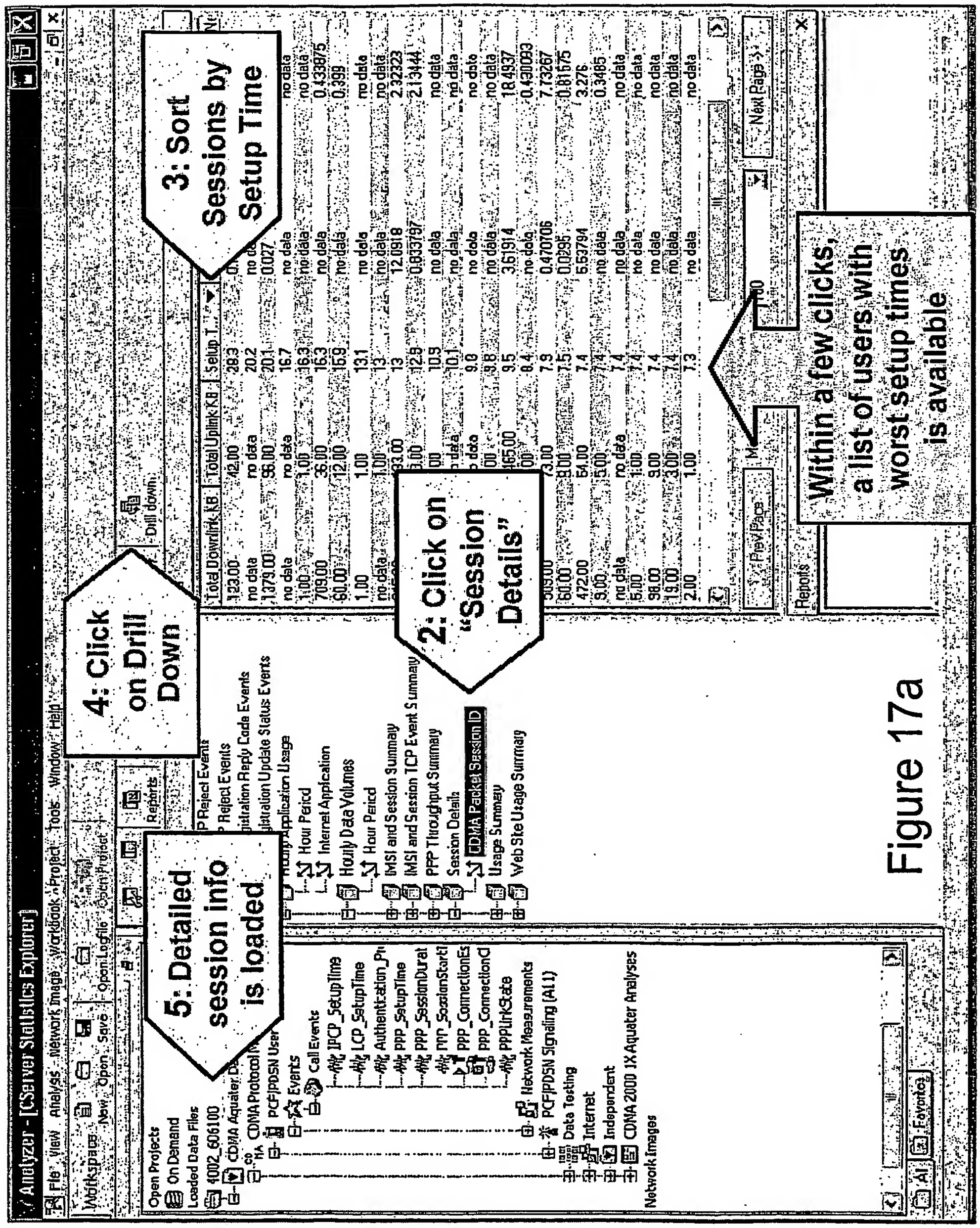

3: Sort Sessions by Setup Time
4: Click on Drill Down
2: Click on "Session Details"
5: Detailed session info is loaded
Within a few clicks, a list of users with worst setup times is available
Drill down
Next Page
Prev Page
Reports
Open Project
On Demand
Loaded Data Files
Hourly Application Usage
Hour Period
Internet Application
Hourly Data Volumes
Hour Period
IMSI and Session Summary
IMSI and Session TCP Event Summary
PPP Throughput Summary
Session Details
CDMA Packet Session ID
Usage Summary
Web Site Usage Summary
Call Events
IPCP_SetupTime
LCP_SetupTime
Authentication_Pr
ppp_SetupTime
ppp_SessionDurat
ppp_SessionStartT
ppp_ConnectionEs
ppp_ConnectionD
pppLinkState
Network Measurements
PCF/PDSN Signaling (All)
Data Testing
Internet
Independent
CDNA 2000 1X Aquater Analyses
Network Images

Figure 17a

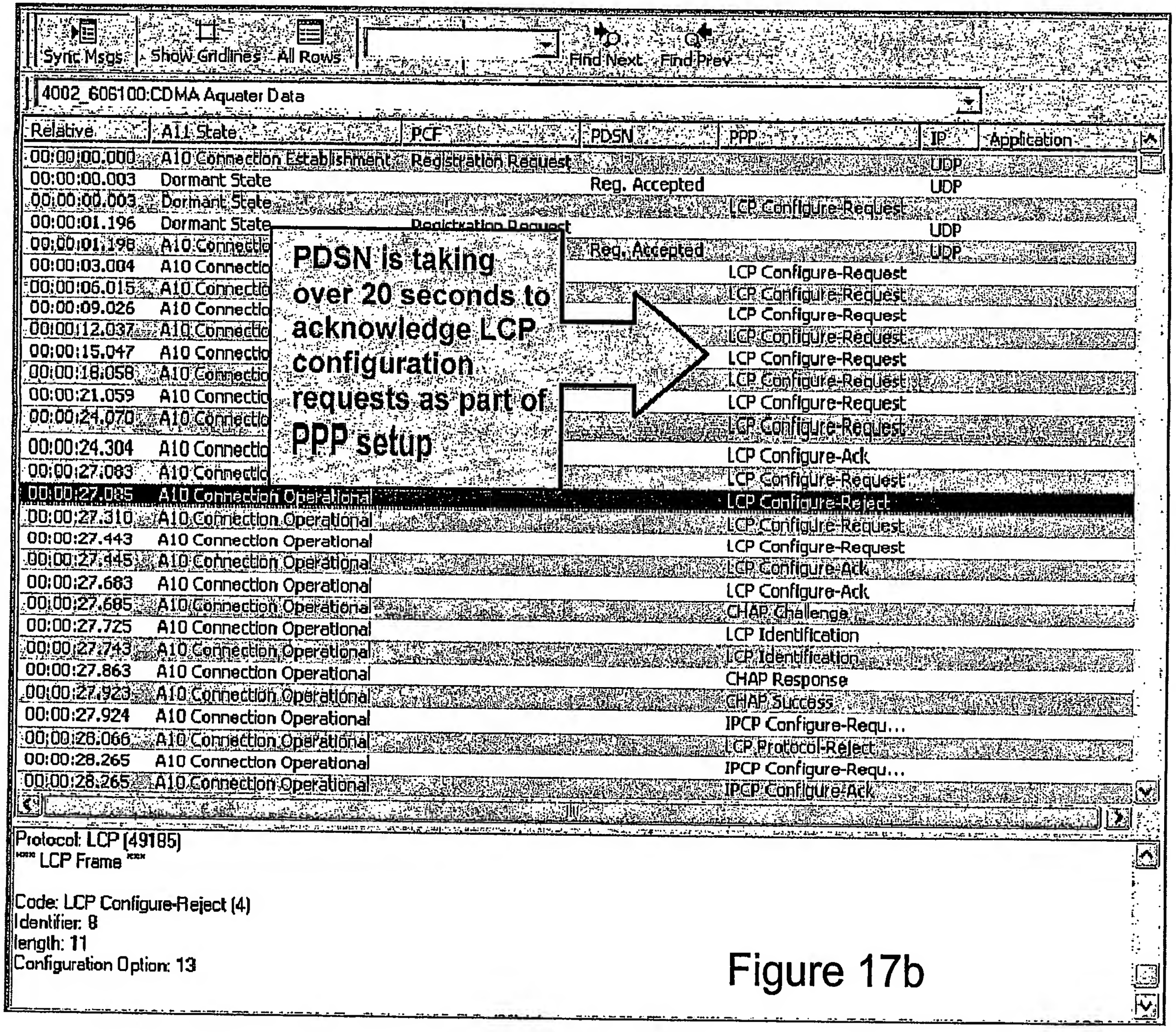

Sync Msgs
Show Gridlines
All Rows
Find Next
Find Prev
4002_606100:CDMA Aquater Data
Relative
A11 State
PCF
PDSN
PPP
IP
Application
00:00:00.000 A10 Connection Establishment Registration Request UDP
00:00:00.003 Dormant State Reg. Accepted UDP
00:00:00.003 Dormant State LCP Configure-Request
00:00:01.196 Dormant State Registration Request UDP
00:00:01.198 A10 Connectio Reg. Accepted UDP
00:00:03.004 A10 Connectio LCP Configure-Request
00:00:06.015 A10 Connectio LCP Configure-Request
00:00:09.026 A10 Connectio LCP Configure-Request
00:00:12.037 A10 Connectio LCP Configure-Request
00:00:15.047 A10 Connectio LCP Configure-Request
00:00:18.058 A10 Connectio LCP Configure-Request
00:00:21.059 A10 Connectio LCP Configure-Request
00:00:24.070 A10 Connectio LCP Configure-Request
00:00:24.304 A10 Connectio LCP Configure-Ack
00:00:27.083 A10 Connectio LCP Configure-Request
00:00:27.085 A10 Connection Operational LCP Configure-Reject
00:00:27.310 A10 Connection Operational LCP Configure-Request
00:00:27.443 A10 Connection Operational LCP Configure-Request
00:00:27.445 A10 Connection Operational LCP Configure-Ack
00:00:27.683 A10 Connection Operational LCP Configure-Ack
00:00:27.685 A10 Connection Operational CHAP Challenge
00:00:27.725 A10 Connection Operational LCP Identification
00:00:27.743 A10 Connection Operational LCP Identification
00:00:27.863 A10 Connection Operational CHAP Response
00:00:27.923 A10 Connection Operational CHAP Success
00:00:27.924 A10 Connection Operational IPCP Configure-Requ...
00:00:28.066 A10 Connection Operational LCP Protocol-Reject
00:00:28.265 A10 Connection Operational IPCP Configure-Requ...
00:00:28.265 A10 Connection Operational IPCP Configure-Ack
PDSN is taking over 20 seconds to acknowledge LCP configuration requests as part of PPP setup
Protocol: LCP (49185)
*** LCP Frame ***
Code: LCP Configure-Reject (4)
Identifier: 8
length: 11
Configuration Option: 13

Figure 17b

Msg No.	Absolute	Relative	Offset	Message	RRC Cause	Layer 3	Events
000652	12:28:57.008	00:01:41.008	000000	BCCH-BCH SysInfoType1			
000653	12:28:57.008	00:01:41.008	000000	BCCH-BCH SysInfoType7			
000669	12:29:00.152	00:01:44.152	003144	UL-CCCH RRCConnectionRequest	RRC registration		
000683	12:29:03.267	00:01:47.267	003115	UL-CCCH RRCConnectionRequest	RRC registration		
000687	12:29:03.698	00:01:47.698	000431	DL-CCCH RRCConnectionSetup			
000688	12:29:04.318	00:01:48.318	000620	UL-DCCH RRCConnectionSetupComplete			
000693	12:29:04.679	00:01:48.679	000361	UL-DCCH InitialDirectTransfer		GPRS MM Attach request	
000694	12:29:04.679	00:01:48.679	000000			GPRS MM Attach request	
000695	12:29:04.959	00:01:48.959	000280	DL-DCCH DownlinkDirectTransfer		GPRS MM Attach Accept	
000696	12:29:04.959	00:01:48.959	000000			GPRS MM Attach Accept	
000697	12:29:04.969	00:01:48.969	000010	UL-DCCH UplinkDirectTransfer		GPRS MM Attach complete	GPRS Attach Successful
000698	12:29:04.969	00:01:48.969	000000			GPRS MM Attach complete	
000712	12:29:07.874	00:01:51.874	002905	UL-DCCH UplinkDirectTransfer		GPRS SM Activate PDP Context request	
000713	12:29:07.874	00:01:51.874	000000			GPRS SM Activate PDP Context request	
000714	12:29:08.524	00:01:52.524	000650	DL-DCCH RadioBearerSetup			
000715	12:29:08.565	00:01:52.565	000041	UL-DCCH RadioBearerSetupComplete			
000720	12:29:08.835	00:01:52.835	000270	DL-DCCH MeasurementControl			
000721	12:29:09.055	00:01:53.055	000220	DL-DCCH DownlinkDirectTransfer		GPRS SM Activate PDP Context accept	GPRS PDP Context Activation Successful
000722	12:29:09.055	00:01:53.055	000000			GPRS SM Activate PDP Context accept	
000726	12:29:09.246	00:01:53.246	000191	UL-DCCH MeasurementReport			
000731	12:29:10.377	00:01:54.377	001131	DL-DCCH RadioBearerReconfiguration			
000741	12:29:11.779	00:01:55.779	001402	UL-DCCH RadioBearerReconfigurationComplete			
000749	12:29:14.233	00:01:58.233	002454	UL-DCCH MeasurementReport			
000769	12:29:19.010	00:02:03.010	004777	UL-DCCH MeasurementReport			
000800	12:29:28.013	00:02:12.013	009003	UL-DCCH MeasurementReport			
000824	12:29:34.061	00:02:18.061	006048	UL-DCCH MeasurementReport			
000845	12:29:40.210	00:02:24.210	006149	UL-DCCH MeasurementReport			
000859	12:29:42.834	00:02:26.834	002624	UL-DCCH UplinkDirectTransfer		GPRS SM Deactivate PDP Context request	
000860	12:29:42.834	00:02:26.834	000000			GPRS SM Deactivate PDP Context request	
000861	12:29:43.264	00:02:27.264	000430	DL-DCCH DownlinkDirectTransfer		GPRS SM Deactivate PDP Context accept	GPRS PDP Context Deactivation Successful
000862	12:29:43.264	00:02:27.264	000000			GPRS SM Deactivate PDP Context accept	
000864	12:29:43.284	00:02:27.284	000020	UL-DCCH UplinkDirectTransfer		GPRS MM Detach request	GPRS Detach Successful
000866	12:29:43.284	00:02:27.284	000000			GPRS MM Detach request	GPRS Detach Successful
000867	12:29:43.485	00:02:27.485	000201	DL-DCCH RadioBearerRelease			
000872	12:29:43.675	00:02:27.675	000190	DL-DCCH DownlinkDirectTransfer		GPRS MM Detach accept	
000873	12:29:43.675	00:02:27.675	000000			GPRS MM Detach accept	
000878	12:29:44.937	00:02:28.937	001262	UL-DCCH RadioBearerReleaseComplete			
000879	12:29:45.227	00:02:29.227	000290	DL-DCCH RRCConnectionRelease			
000880	12:29:45.237	00:02:29.237	000010	UL-DCCH RRCConnectionReleaseComplete			

000295 12:28:04.873 GPRS MM - DETach REQuest UL-DCCH UplinkDirectTransfer

UL_DCCH_Message
- message: uplinkDirectTransfer
- cn_DomainIdentity_0: RRC_ps_domain
GPRS Protocol discriminator: GPRS Mobility Management Msg Type: Detach request Force to standby: Force to standby not indicated Power Off: normal detach, Detach Type: (MS->net: GPRS detach) or (net->MS: re-attach required)
Mobile identity[0]: 244, [1]: 24, [2]: 144, [3]: 75, [4]: 56

EI: Radio Cause, P-TMSI signature 2: 11288539
GPRS MM - DETach REQuest

Figure 17c